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quantities a report must be made within five days to the secretary of the State board of health. The law of North Dakota restricts the sale of cocaine to distribution or prescription by physicians, dentists, and veterinarians. Prescriptions for heroin, on the other hand, may be written only by a physician duly licensed in North Dakota.

The laws of California, Colorado, Connecticut, Massachusetts, Michigan, New York, Pennsylvania, Vermont, Hawaii, and the Philippine Islands provide for the treatment of inebriates in public institutions or their commitment to State or city hospitals.

In Utah, physicians are required to report the treatment of drug users to the State board of pharmacy within 24 hours after the first treatment. In Nebraska the law forbids the prescribing for addicts unless determined to be necessary by two reputable and duly licensed physicians. A record of the treatment is to be made and a copy sent within five days to be filed with the county attorney. The laws of Colorado, Connecticut, Idaho, Illinois, South Dakota, and Utah provide for the revocation of licenses to practice any of the enumerated professions held by drug addicts or by repeated violators of the antinarcotic law.

The law in New York restricts the sale of hypodermic needles and of hypodermic syringes. An ordinance to the same effect has been adopted by the city of Norfolk, Va. The latter ordinance also requires that duplicate copies of each prescription be filed with the department of health within 24 hours after its issuance.

A recently enacted law of Kansas makes it unlawful for a person under the influence of liquor or any exhilarating drug to drive or have charge of any vehicle propelled by other than muscular power.

California requires that instruction be given in all grades of schools and in all classes on the nature of alcohol and narcotics and the effects on the human system. Teachers are to be specially examined on this subject.

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## DEMONSTRATIONS OF MALARIA CONTROL.

By R. H. VON EZDORF, Surgeon, United States Public Health Service.

In the course of systematic malarial investigations carried on by the United States Public Health Service during the past three years, a number of towns and cities have been visited by the officers engaged in the work, who made malarial surveys of the localities visited, including Anopheline surveys and the taking of malarial indexes. At most of the places visited the local authorities cooperated and were interested and desirous to profit by the surveys. Among the first places

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where such studies were conducted and where antimalarial measures were undertaken along the lines suggested were Roanoke Rapids, N. C., and Electric Mills, Miss.—two places differing widely in their geographical, climatic, and industrial conditions. The following is a description of the places and of the measures applied in the practical control of malarial fevers.

#### ROANOKE RAPIDS, N. C.

Roanoke Rapids is a small town on the Roanoke River, in Halifax County, in the northern part of the State. Rosemary mill village and Patterson mill village, together with the town of Roanoke Rapids, cover about 4 square miles. This territory is bounded by the Seaboard Air Line Railroad tracks to the south, the Roanoke River to the north, and woods to the east and west.

*Character of land.*—The country is somewhat rolling and in ridges, having a sandy soil, with a clay and gravel subsoil that is not very porous. There is a canal which parallels the river about one-fourth of a mile distant and three-fourths of a mile north of the town of Roanoke Rapids. The land between the canal and the river is rather low, and in places marshy in character.

*Natural water courses.*—The main water courses between ridges drain in a northerly direction and empty into the river or canal. The Rosemary branch begins at Rosemary and courses northward, then westward, and empties into the canal. The Bunker Hill branch begins at an arm of the Rosemary branch and courses eastward through the north part of Roanoke Rapids, where it is joined by another branch known as the "Drug Store Branch," which passes directly through the town of Roanoke Rapids, through open land and partly under a street and some buildings, and empties into the canal. On the east side are two branches, one beginning in Roanoke Rapids, another rising from springs and seepage water at the Patterson mill village, and these course in general north to empty into the canal. The greater part of all of these branches course through the bordering woods. To the south of the railroad track and about one-fourth of a mile from Rosemary mill is Chockoyotte Creek, which runs from west to east. A ditch for waste water and drain from cesspools from Rosemary mill crosses the railroad tracks and empties into the creek.

*Climatic conditions.*—The climate is temperate with fairly severe winters, and snow as late as March. The mosquito-breeding season extends from six to seven months of the year, beginning about May and terminating in October or November.

*Population, industries, and water supplies.*—The population in 1913 was estimated to be 1,800 for Roanoke Rapids, 300 for Patterson mill

village, and 2,000 for Rosemary, giving a total of 4,100. There has been an increase during the past year. It is said that on account of sickness prevailing, mainly malaria, the population was a fluctuating one. The people are all white, with the exception of about 25 negroes. The general population is composed of a high class of business men and a good class of workmen. The people are employed mainly in the various cotton and paper mills located there.

The houses, with the exception of a few business places, are frame structures, and are well built. Surface closets were in general use and a form of sanitary privy of the dry-bucket system type was installed during the fall of 1913. During the year 1913 46 cases of typhoid fever were reported; for 1914 no cases were reported; and for the year 1915 two imported cases occurred, none originating in the town and villages. About 70 per cent of the population in Roanoke Rapids were vaccinated against typhoid fever during the years 1914 and 1915. The water supply is from driven wells ranging from 75 to 412 feet in depth.

#### Malaria Prevalence.

The health officer has been employed by the mills since August 1, 1910, to render medical services to the employees and their families. He states that 75 per cent of the people in the town of Roanoke Rapids had malaria during the summer of 1910, and that its prevalence during 1911, 1912, and 1913 was as great. As a result of the excessive prevalence of this disease, people were coming and going, so that it was estimated that 50 per cent of the population were in a sense transients. Mills were operating short handed much of the time during these years.

The medical services in attending the sick suffering from malarial fevers became quite arduous, so that during the four months of June, July, August, and September, 1913, visits on account of malaria alone averaged about 50 per day. At times there were three, four, and even as many as seven members of a family suffering with malaria at the same time. An endeavor was made to introduce the prophylactic use of quinine, but only a few people followed the advice given.

Asst. Surg. Gen. H. R. Carter made a visit to the place and conducted a survey to ascertain the conditions contributing to the endemicity of malaria. In his report on malaria in North Carolina, published in the Public Health Reports of December 19, 1913,<sup>1</sup> the following statement appears:

Anopheles larvae in some stage were found in almost every part of every rivulet and pool examined—many small ones only, in places in which one would not have expected to find them. The same was true of a small morass and stream in Patterson village and close enough to infect both ridges on which it is built. This marsh had

<sup>1</sup> Reprint No. 156.

Public Health Reports, March 10, 1916.



United States Public Health Service.

FIG. 1.—SEEPAGE WATER COLLECTED IN POOLS AT BASE OF HILL. EVERY POOL A PROLIFIC BREEDING PLACE OF ANOPHELES QUADRIMACULATUS.



United States Public Health Service.

FIG. 2.—BEFORE CLEARING AND DITCHING.



FIG. 3.—SHOWING CLEARING AND DITCHING  
DONE.



FIG. 4.—DITCHING OF LOW AREA OF POOL FORMED BY SEEPAGE WATER.  
MALARIA PREVAILED AMONG TENANTS IN ALL HOUSES.

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been burnt over some weeks previously by the use of coal oil, and no full-grown larvae were found in it. None were found in wells, although search was made for them. *Culex* was found in wells.

The problem of ridding this town of malaria is a difficult one on account of its cost, due to the large area and small number of people. Each ridge of houses has a breeding place close enough to infect—sometimes one on each side. Fortunately the personality of the principal people here promises much. They are energetic and in earnest and are good business men. I believe that they will rid the place of malaria or reduce it to a minimum. It is proposed (1) to drain and clean the marsh and its effluent next to Patterson village and then to turn the dye from that mill into its head. This will eliminate this long and dangerous drain. (2) An effort will be made to use the waste from the paper mill to destroy breeding places in its vicinity. The dye from the Roanoke Rapids Cotton Mill may also be thus utilized. (3) Such drains as can not be so treated it is proposed to put underground in terra cotta or galvanized iron pipes. This will be costly, but the mayor, a young man and an engineer, believes it will be feasible and will pay in increased good health and efficiency of the people. (4) If it be impracticable to cover all of the drains, an effort will be made to stock the lower reaches, where the water lies in still pools, with top minnows, where I think they will thrive, and cover the remainder. The health officer is going to take this matter up this fall with the United States Fish Commission.

I remained over four and one-half days in all at this place to talk over the plans for its sanitation with the mayor, health officer, and the different mill owners and help them formulate plans for cooperation in this work. They all agreed, and it is unquestionably true, that the lessened loss from sickness and the increased efficiency which will result from eliminating or nearly eliminating malaria here will justify a considerable expense. That the mayor is an engineer, and that the mill owners are business men, used to investing money for the sake of getting returns, makes the prospects good for results here.

During October 10 to 14, 1913, a visit to Roanoke Rapids was made by the writer. At this time a second Anopheline mosquito survey was made, yielding the same findings as those noted by Asst. Surg. Gen. H. R. Carter. In many places on both banks of the water courses flat areas of a marshy character caused by seepage water were of frequent occurrence and were found to be prolific sources of *Anopheles quadrimaculatus* mosquitoes. Two of these areas were at the bases of steep hills, on top of which malaria was prevalent. During this visit a malarial index was taken. It is to be noted that malaria prevailed principally among the residents of Patterson mill village and Roanoke Rapids and that comparatively little malaria occurred at Rosemary. The reason for this is that the mill tenements at the first two mentioned places are built on ridges not far from the small water courses, and therefore within easy distance of flight of the Anopheline mosquitoes breeding there, whereas at Rosemary the natural breeding places for the Anophelines are more distant.

TABLE 1.—*Blood examinations, October, 1913.*

Age.	Previous history.				Total examined.	Number infected, white.		Types of infection.		Total infected.	
	Positive white.		Negative white.			M.	F.	T.	E. A.		
	M.	F.	M.	F.							
1 to 3 years.....	2	.....	1	.....	3					.....	
4 to 5 years.....	2	2	2	2	6	1	2	3	3	3	
6 to 9 years.....	37	42	15	17	111	11	4	11	4	15	
10 to 14 years.....	48	59	21	14	142	8	9	12	5	17	
15 to 19 years.....	21	17	3	2	43	5	2	5	2	7	
20 to 29 years.....	27	14	5	2	49	5	.....	4	1	5	
30 to 39 years.....	16	5	.....	2	23	2	1	3	.....	3	
40 years and over.....	12	7	3	1	23	2	3	2	3	5	
	165	146	48	40	400	34	21	40	15	55	

<sup>1</sup> 1 positive history, female, colored, age 25.

Total examined, 400; total infected, 55, or 13.75 per cent.

From this it will be seen that about one person out of every seven examined showed parasites of malaria in the blood; the tertian type prevailed. A report of the positive findings, by name, was made to the health officer in order that he might advise those affected and institute treatment of the carriers.

A census was made October 15, 1913, of all persons living on four blocks in Roanoke Rapids with special reference to the history of chills and fever of each individual. This census was taken by a trained nurse under the direction of Dr. Long and showed that 233 persons, or 46.6 per cent, of the 500 persons residing in these four squares reported having had chills and fever during the period June 1 to October 15, 1913.

*Prevalence of infections shown by blood examinations.*—Blood smears were secured, one thick and one thin film, from each person submitting himself for the examination. These were taken at random from any and all persons who were apparently in good health, the majority from children who were in attendance at school. A tabulated list of those examined, according to age, sex, color, previous history of malaria, together with the results of the microscopic findings, is given above.

#### Malaria Control.

The directors of the mills indicated their desire to undertake what was necessary to control the malaria, to give their financial support, and to secure the cooperation of the other mills interested. The health officer at once took steps to secure a fund for conducting an antimalarial campaign, making plans for the work to begin early in the year. The directors of the various mills gladly contributed to making up the necessary fund for undertaking the project.

Lectures were given at the opera house and in the graded schools on the subject of malaria, its cause, and prevention. The rôle of mosquitoes in the spread of the disease was especially emphasized. Destruction of mosquitoes and their breeding places, screening of houses, use of mosquito bars, and the prophylactic use of quinine were all discussed as means of prevention. A poster, emphasizing especially the use of quinine, was posted in the hotels and other public places by the health officer, Dr. Long.

An inspection of the work in progress was made by the writer in February, 1914, to advise further in the work. Again June 22 to 24, 1914, Sanitary Engineer J. A. A. Le Prince made a survey. During this inspection he instructed the special inspector of mosquito-breeding areas in the details of checking up the results and effects of measures in use.

Another general survey was made October 1 to 5, 1914, when Surg. R. H. von Ezdorf and Asst. Surg. R. C. Derivaux secured blood smears from 780 persons for examination, to determine the prevalence of infection after antimalarial measures had been in progress for a year. The following is a table giving the result of these examinations, according to age:

TABLE 2.—*Blood examinations, October, 1914.*

Age.	Number examined.				Total examined.	Number infected white.				Types of infection.				Total infected.		
	White.		Colored.			M.	F.	M.	F.	T.	Q.	E.A.	Mixed.			
	M.	F.	M.	F.												
1 to 3 years....		1	1		2											
4 to 5 years....		1	1		3											
6 to 9 years....	85	85		6	176	2	6	5		2	1			8		
10 to 14 years....	97	121	1	1	220	2	4	5		1				6		
15 to 19 years....	58	70		1	129	2	5	5		2				7		
20 to 29 years....	72	54		1	127	4	4	7	1					8		
30 to 39 years....	54	11		1	66	1	3	4						4		
40 and over....	53	3			56	2		2						2		
Not stated....		1			1											
	419	347	3	11	780	13	22	28	1	5	1			35		

Total examined 780, total infected 35, or 4.48 per cent.

At the same time, October, 1914, Sanitary Engineer J. A. A. Le Prince made a mosquito survey, examining 6.9 miles of ditching, and all other places which might serve for breeding of Anopheline mosquitoes. He found no Anopheles larvae in any place where work had been done except in some hoof prints of cattle near one of the ditches. He found Anophelines breeding in Chockoyotte Creek, one-fourth of a mile to the south of Rosemary. There are some woods intervening between the creek and Rosemary.

*Measures employed.*—The work of training of streams, straightening of banks and clearing them of underbrush, leveling of ditches

and cutting of new ditches, was begun in January, 1914, and continued, when weather conditions permitted, through the months of February, March, April, and part of May. Oiling by use of oil drips supplemented the ditching work. A sanitary inspector, whose duty was to follow up the work and look after the filling of oil cans, maintenance and clearing of ditches, was on duty throughout the season until November 1, 1914.

A summary of the work, labor, materials used, and the cost of the antimalarial work done during the first year, beginning January 17, 1914, and ended December 1, 1914, is here given:

Ditching.....	miles..	6. 9
Land cleared of underbrush.....	acres..	40
Tin cans, etc., removed.....	wagon loads..	59
Quantity of oil used.....	gallons..	3,000
Time when oiling started, May 20, 1914.		
Time when oiling stopped, Nov. 1, 1914.		
Cost:		
Labor for ditching and clearing.....		\$2,422.22
Services of inspector.....		213.30
Oil, 3,000 gallons.....		212.70
Tools and supplies.....		231.46
Pipe.....		265.50
Blasting work.....		56.25
Hauling.....		41.95
Team hire.....		47.35
Repair work.....		6.05
Freight charges on oil, etc.....		111.32
Incidentals.....		75.31
Total.....		3,683.61

At the Patterson Mill village, the waste water from the bleaching plant was diverted by new ditching into a branch having its origin at that place with the object of having this waste serve as a larvicide. Some oil drip cans were installed over some lateral ditches entering this branch; these lateral ditches were installed chiefly to carry off seepage outcrops.

It must be added that a number of persons took quinine as a prophylactic measure during the season. The drug store reports at Roanoke Rapids showed that between June 1, 1913, and October 1, 1913 (before antimalarial work), 1,742 prescriptions were filled, 380 of these, or 22 per cent, being for quinine, and for the period June 1, 1914, to October 1, 1914 (after antimalarial work), 1,535 prescriptions were filled, of which 226, or 14½ per cent, were for quinine. Much of this last was prescribed for prophylactic use.

*Results obtained.*—The results at the end of the first year were marked. With reference to the prevalence of malaria among the people during the malarial season, June to October, 1914, Dr. Long reports that the average number of cases did not exceed one a day

and that 95 per cent of these were cases that had given the history of having had malaria during the previous year, and were undoubtedly recurrent attacks. Very few cases of new infections had occurred. The cases of malaria were more numerous during the early months of May and June, decreasing each month thereafter, and at the time of the writer's visit in October, 1914, the health officer stated that he had not seen a new case in three days.

It was evident that instead of the number of cases increasing during the months of August and September as had occurred during previous years, and is true generally in this country, the prevalence of malaria in this region had decreased.

A census of the people living on four blocks in Roanoke Rapids, one year after antimalarial measures were instituted, showed that 33 per cent gave a history of having had chills and fever as against 49.8 per cent during the previous year.

The health officer in his official report makes the following statement with reference to this:

During the summer of 1913, prior to any antimalarial work, the mills were constantly short of help on account of a large number sick from malaria. During the past summer there never has been a day when the mills did not have sufficient help, and it was a frequent occurrence, notably at the Roanoke Mills, that help had to be turned away. It is true that a number of people had malarial chills during the summer of 1914, but as 95 per cent of them were recurrences from an infection of the previous year they were easily controlled, and the operatives in rare instances had to quit work. It is a fact that 95 per cent of all cases of malaria occurring during the past malarial season bore the history of having had the disease in the year prior, very few newcomers being infected.

A comparative statement of the results may be briefly summarized:

Prevalence of infection shown by blood examinations:	Per cent.
October, 1913.....	13.75
October, 1914.....	4.48
Reduction in the incidence of malaria carriers (in 1 year).....	67.7
Prevalence of infection shown by house-to-house inquiry:	
October 15, 1913.....	49.8
October 15, 1914 (95 per cent of these were relapses).....	33.0
Reduction in incidence, clinically reported.....	33.0

The manager of the Roanoke Rapids Mills stated that at no time has labor been more efficient and sufficient, attendance more steady, and sickness less, and that the returns for the contribution of \$1,000 of this one mill were more than gained in one month's (September) operation of the mill.

#### CONTINUATION OF WORK.

*Records and surveys for 1915.*—Dr. Long, the health officer, secured a fund of \$1,500 to continue the work during 1915. Ditches were cleared of obstructions, and of grass and other vegetation, the banks were straightened, and some additional ditching was done. Oil-drip

cans were placed, making the total number of oil cans 186, of which number 140 were in daily use. The drip cans had a capacity of 5 gallons each and were regulated to deliver 18 to 25 drops of oil per minute. It was found that these required refilling about every three weeks. Oil drips were operated from April 7 to October 1, 1915, and 83 barrels of oil were used during this period.

Inspection of ditches, oil cans, and the effects of oiling was made three times a week, requiring one-half day at each inspection. The inspector would also, in the course of his inspections, do some work toward maintenance by clearing ditches of such obstructions as are generally to be found after heavy rains and storms. He also carried an air-pressure oil tank for spraying pools of water with oil, especially on the days following a rain.

An inspection of the work done was made by Assistant Epidemiologist T. H. D. Griffitts and Sanitary Engineer J. A. A. le Prince on August 19 and 20, 1915, when most excellent conditions were found to be prevailing. A survey was again made September 24 to 28, 1915, by Surg. R. H. von Ezdorf and Technical Assistant H. A. Taylor. Seven miles of main ditching, having 81 lateral ditches, were examined. *Anopheles* larvæ were found in only a few places in small pools of water standing along the banks of these ditches. These were of no sanitary importance. In a number of culverts a few imagos of the *Anopheles punctipennis* were caught. Considerable propagation of Anophelines was found in one ditch running southward from Rosemary Mill and emptying into Chockoyotte Creek.

During this visit 998 blood smears were secured from school children and other persons living in Roanoke Rapids and vicinity to determine the prevalence of malarial infection. The results of the examinations are grouped according to age in the table which follows:

TABLE 3.—*Blood examinations, October, 1915.*  
PERSONS LIVING IN AREA OF ANTIMALARIAL OPERATIONS.

Age.	Number examined—white.			Number infected—white.			Types of infection.		Total infected.
	M.	F.	Total examined.	M.	F.	T.	E. A.		
1 to 3 years.....	1	—	1	—	—	—	—	—	—
4 to 5 years.....	1	4	5	—	—	—	—	—	—
6 to 9 years.....	82	82	164	1	2	3	—	—	3
10 to 14 years.....	103	129	232	3	4	5	2	—	7
15 to 19 years.....	77	97	174	2	7	9	—	—	9
20 to 29 years.....	131	69	200	8	1	8	1	—	9
30 to 39 years.....	91	17	108	4	—	4	—	—	4
40 years and over.....	66	13	79	1	1	2	—	—	2
Not stated.....	2	1	3	—	—	—	—	—	—
No record.....	—	—	2	—	—	—	—	—	—
Total.....	554	412	968	19	15	31	3	34	34

Total examined, 968; total infected, 34, or 3.51 per cent.

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TABLE 3.—*Blood examinations, October, 1915—Continued.*

## PERSONS LIVING OUTSIDE OF AREA OF ANTIMALARIAL OPERATIONS.

Age.	Number examined—colored.			Number infected—colored.		Types of infection.		Total infected.
	M.	F.	Total examined.	M.	F.	T.	E. A.	
4 to 5 years.....	1		1					
6 to 9 years.....	5	15	20	1	3	3	1	4
10 to 14 years.....	2	6	8	1	1	1	1	2
15 to 19 years.....								
20 to 29 years.....	1		1					
Total.....	9	21	30	2	4	4	2	6

Total examined, 30; total infected, 6, or 20 per cent.

The one group of 968, with 3.51 per cent of malaria carriers, represents the persons living within the area where drainage and oiling work was done; and the second group of 30, with 20 per cent of malaria carriers, is made up from colored persons living outside this area.

No records were kept as to the exact number of cases of malaria that had occurred during the year 1915. Dr. Long reports that the number of cases treated by him averaged approximately one every three days for the whole period of the malarial season, of which number practically all were recurrent cases; three cases occurred during the year that might possibly be considered by him as new infections.

Dr. Garman stated that there had been six cases in his practice during the year, all of which were either contracted outside or were recurrent cases.

Dr. Beckwith treated 15 cases, all of which were relapses with the possible exception of one.

During the time of this visit, on September 24 to 28, 1915, there was not a person sick in bed with malaria as reported by the four physicians practicing here, and this among a total population of 4,600 (Roanoke Rapids, population 2,000; Patterson mill, population 600; Rosemary, population 2,000). Dr. Long had under his professional care during the month of September, 1915, only three cases of malaria, all of which were relapses.

A census taken October 15, 1915, of 530 people living in the area of four blocks in Roanoke Rapids, showed that 101, or 19 per cent, gave a history of having had chills and fever some time during the year, and 429, or 81 per cent, did not. The nurse stated that all those who gave a history of having chills this year, 1915, also gave a history of having had it prior to this year.

A statement, prepared by Dr. Long, of the work done, materials used, and the cost during 1915, is here given:

Maintenance of ditches, etc.....	\$667.18
Services of inspector.....	231.75
Oil, 5,295 gallons.....	334.27
	_____
Total cost (1915).....	1,233.20

Began oiling April 10 and continued to November 1, 1915.

Roanoke mills, the employees of which were most affected by malaria in previous years, had during the year 1915 the greatest output in the history of the mill for the same period of time under the same management and with the same number of operatives.

The Patterson mill changed management during the year, but efficiency is known to have increased on account of better health of the employees. The population in the villages at Roanoke Rapids and Patterson mill village has increased. There were no families leaving on account of sickness, as was the case during the previous year.

The following letter received recently from the manager and treasurer of the Roanoke Mills Co. is here given in full. It presents the business man's viewpoint and gives an estimate of the economic returns from an investment for antimalaria work.

ROANOKE MILLS COMPANY,  
MANUFACTURERS OF COLORED COTTON GOODS,  
*Roanoke Rapids, N. C., December 27, 1915.*

Surg. R. H. von EZDORF,  
*U. S. Marine Hospital, New Orleans, La.*

DEAR DOCTOR: In answer to your recent favor I wish to say that during September, 1912, we averaged 66 looms standing per day for the want of weavers; during September, 1913, we averaged 25 looms standing per day for the want of weavers; during September, 1914, after the antimarial work had been completed, we had no difficulty in running our looms, and during September, 1915, we have had the greatest abundance of help.

I told you once before that in September, 1913, we worked 26 days and produced 238,046 pounds of cloth; during September, 1914, we worked 26 days and produced 301,151 pounds of cloth; during September, 1915, we worked 26 days and produced 316,804 pounds of cloth.

Dr. Long has written you fully, I believe, as to the improved health conditions due to the antimarial work and the sanitary measures taken, but I want to add that I consider that Roanoke Rapids under the new order of things is as healthy as any mill town in the State; in fact, I do not know of one that can duplicate our record for the past two years in regard to the absence of typhoid fever.

I will frankly admit that I could not realize what a great change could be brought about by systematic work and with comparatively little expense. The money spent in antimarial work here has paid the quickest and most enormous dividends I have ever seen from any investment, and after having had our experience I would, if necessary, do the work over again if I knew it would cost ten times the amount.

I want to take occasion to thank you and, through you, the United States Public Health Service for the very prompt and wonderfully efficient manner in which you answered Dr. T. W. M. Long's request for assistance and advice.

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I am more than anxious to see the towns in eastern Carolina and other places where they are troubled with mosquitoes adopt the same methods we have here, and if I can be in any way instrumental in bringing about this result I will be glad to have you call on me at any time.

I will close by adding that our experience has taught us that the eradication of mosquitoes is not only the proper thing to do from a strictly health standpoint but it is an exceedingly profitable thing to do.

Thanking you for your many past favors and with kindest regards, I beg to remain,

Very truly, yours,

ROANOKE MILLS COMPANY,  
By (signed) S. F. PATTERSON, *Treasurer.*

#### Summary.

Summarizing for the years 1913, 1914, and 1915, it is shown:

1. During October 1 to 5, 1913, Dr. T. W. M. Long estimated that 200 persons were sick in bed with malaria; on October 1, 1914, only one person; and on September 24 to 28, 1915, none.

2. Malarial prevalence shown by blood examination:

1913, in 400 persons examined, 13.75 per cent found infected; 1914, in 780 persons examined, 4.48 per cent found infected; 1915, in 968 persons examined (persons living in area where antimalarial work was done), 3.51 per cent found infected; 1915, in 30 persons examined (persons living outside of area where antimalarial work was done), 20 per cent found infected.

3. A house-to-house census taken of persons residing on four blocks in Roanoke Rapids showed that 48.9 per cent gave a history of having had chills and fever during the period June 1, 1913, to October 15, 1913; 33 per cent for the same period 1914; and 19 per cent for the same period 1915; or a reduction in the incidence of sickness of 61.1 per cent for the two years, as shown by personal histories. (These histories are not, however, considered entirely accurate.)

4. In 1913, *Anopheles quadrimaculatus* mosquitoes were found breeding extensively, and *A. quadrimaculatus* mosquitoes were readily found in houses; in 1914, practically no breeding, only few found; and in 1915, only few *Anopheles punctipennis* found, and no propagation of sanitary importance.

5. The population of Roanoke Rapids and Patterson mill village was most seriously affected by malaria; Rosemary mill village the least.

6. Malaria was increasing in prevalence as the season advanced, June to November, 1913; decreasing for the same months for the years 1914 and 1915. These results were obtained although malaria was unusually prevalent during 1915 in this State.

7. During the year 1913 the estimated number of cases treated in the practice of Dr. Long averaged 50 a day; in 1914, one a day, of which number 95 per cent were relapses; and for the year 1915 the estimated average was one case in three days, of which practically all were relapses.

8. The efficiency of employees as rated by the Roanoke Rapids mills has increased each year since antimalarial work was instituted, more than compensating for the expenditures incurred for this work.

9. Cost of antimalarial work for 1914 was \$3,600; for 1915, \$1,500.

10. In 1913 and the year previous population fluctuated to the extent of 50 per cent on account of sickness caused by malaria; since 1914 population has increased by 500 and is more permanent.

11. Special mention must be made of the enthusiastic activity of the health officer, Dr. T. W. M. Long, in carrying out all details in the work. His success in this must also be attributed to the material help given him by the directors of the mills, and to the cooperation of the town authorities, mill managers, business interests, and the people.

#### ELECTRIC MILLS, MISS.

Electric Mills, Kemper County, is located north of Meridian, in the eastern part of the State of Mississippi, on the Mobile & Ohio Railroad.

The region is part of the eastern border of the prairie belt, not a prairie soil in a true sense, but clay and sand, so called "crawfish" clay, highly impervious to water, and becomes heavy and tenacious in wet weather.

The country is a flat woods district, rolling in character. The highest point in the town is 23 feet above a creek bed one-half mile away.

Drainage is in two general directions—toward Bodka Creek on the south, and toward a small unnamed branch on the north which empties into Bodka Creek southeast of the town.

The town is surrounded on the north, south, and east by slow-moving watercourses, which run only a part of the year, being partly dry during the summer and fall. There is no stream of any consequence on the west for 3 miles.

On the west side of the town is a large artificial pond, covering an area of 35 acres, which is used for logging purposes. This pond is well stocked with native fish. The pond has no outlet except seepage through a dam which heads the creek to the north of the town.

It is essentially a lumber-mill town, having a mill to the west side of the railroad, and the offices, commissary, and tenant houses, all good frame structures, built to the east side of the tracks. There are also some tenant houses for colored people on the west side of the tracks and south of the mill.

The town is divided into blocks, with 60-foot streets; sidewalks are of cement; a wide alley runs through the center of each block.

Between the residential section for whites on the north side and that for negroes on the south side are some intervening woods. The land north and west of the resident section is cleared for agricultural purposes, and it is also cleared to the east and south. In time there

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will be a clear area of at least 500 feet in all directions from the town limits to the bordering woods.

The water supply is from artesian wells, 1,300 feet deep. Sanitary privies of the bucket-system type are provided for all residences.

Dr. Cecil Champenois, the mill physician, in a report to the directors of the lumber company for the month of September, 1912, stated that 95 per cent of the sickness for the month was due to malaria, and that, with two exceptions, one or more members of every white family in the town were attacked. Sickness among the negroes was of an unusual amount. Most of the malaria was contracted in Electric Mills. Upon the urgent request of Dr. Champenois a survey was made of the place during May, 1914, by and under the direction of Asst. Surg. Gen. H. R. Carter.

Breeding places of Anopheles were found—

1. In a number of low, wet areas under lumber piles where the ground was below the road level.
2. In the branch to the north of the town.
3. In some low areas in the town.
4. In borrow pits along the railroad tracks.
5. Along the banks of Bodka Creek.
6. In some drains from leaking hydrants in yards.

It was recommended that training of the branch by clearing and straightening of the banks to and from the artificial pond be done; that some low areas be filled with sawdust, and some drainage ditches cut.

An index of the prevalence of malaria was secured by taking thick blood smears for microscopic examination from 527 apparently healthy persons, May, 1914. The following table gives the results of the examination of these specimens arranged according to ages of the persons from whom the blood was taken.

TABLE 4.—*Blood examinations, May, 1914.*

Age.	Number examined.					Number infected.					Types of infection.			Total infected.	
	White.		Colored.		Total examined.	White.		Colored.							
	M.	F.	M.	F.		M.	F.	M.	F.	T.	E. A.	Mix.			
Under 1 year.....	2	1	4	3	10	.....	.....	1	1	1	.....	.....	.....	1	
1 to 3 years.....	10	7	16	12	45	.....	.....	1	1	2	4	.....	.....	4	
4 to 5 years.....	4	4	9	10	27	.....	1	.....	.....	1	2	.....	.....	2	
6 to 9 years.....	6	9	12	17	44	.....	.....	2	1	3	5	1	.....	6	
10 to 14 years.....	8	4	10	9	31	2	1	3	2	2	6	1	1	8	
15 to 19 years.....	3	8	21	31	63	.....	.....	5	6	9	2	.....	.....	11	
20 to 29 years.....	41	23	55	59	178	5	1	6	1	13	.....	.....	.....	13	
30 to 39 years.....	26	9	21	15	71	6	.....	7	1	11	3	.....	.....	14	
40 years and over.....	11	7	15	16	49	1	1	1	.....	2	1	.....	.....	3	
Not stated.....	3	5	1	.....	9	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Total.....	114	77	164	172	527	15	6	25	16	53	8	1	.....	62	

Total examined, 527; total infected, 62, or 11.76 per cent.

Resurveys were made in the fall of 1914 by Sanitary Engineer Le Prince, and again in April, 1915, by Sanitary Engineer Le Prince and the writer. In April, 1915, it was pointed out that places requiring immediate attention were the few small depressions along the log road and the creek to the south, small depressions on the flat land which could be filled with sawdust and shavings. Some straightening of banks of ditches and natural watercourses that might advantageously have the sides boarded, and a trial given to subsoil wooden drains, especially in the lumber yards, were also recommended.

Blood specimens were again examined in April, 1915, with the following result:

TABLE 5.—*Blood examinations, April, 1915.*

Age.	Number examined.				Number infected.				Types of infection.		Total infected.	
	White.		Colored.		Total examined.	White.		Colored.				
	M.	F.	M.	F.		M.	F.	M.	F.	T.	E. A.	
1 to 3 years.....	1	2			3		1			1		1
4 to 5 years.....	2	1			8							
6 to 9 years.....	7	12	6	12	37							
10 to 14 years.....	7	5	10	9	31							
15 to 19 years.....	2	8	14	3	27							
20 to 23 years.....	21	4	16	3	44	1						
30 to 39 years.....	14	3	11		28							
40 years and over.....	5		7		12	1						
Not stated.....	1	19	1		21		2					
	60	54	65	32	211	2	3	3		7	1	8

Total examined, 211; total infected, 8, or 3.79 per cent.

The following table gives the total number of cases of malarial fever reported by Dr. Cecil Champenois each month:

	1912	1913	1914	1915			1912	1913	1914	1915
January.....	8	3	2		August.....		25	8	10	
February.....	3	3	4		September.....		68	18	6	12
March.....	15	7	7		October.....		61	15	6	12
April.....	10	13	2		November.....		10	10	7	8
May.....	8	9	4		December.....		5	1	2	2
June.....	18	12	3				144	144	85	70
July.....	13	9	4							

Some antimalarial work was done by Dr. Champenois shortly after his locating here in 1912. The cost of the work and materials used for each year is given by him as follows:

1912.		1913.	
Labor.....	\$40.00	Labor.....	\$139.50
Kerosene.....	20.00	Kerosene.....	75.00
Total.....	60.00	Total.....	214.50

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Following the survey in 1914, additional work was done, the cost of which was as follows:

During 1914:

Labor.....	\$139.50
Oil.....	50.00
Ditching.....	450.00
Miscellaneous.....	86.00
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Total.....	725.50

For the year 1915 the cost was:

Labor for draining and filling.....	\$126.80
Oil.....	10.00
Miscellaneous.....	7.00
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Total.....	143.80

*Results of antimalarial measures.*—The number of cases for the last four months of 1913 were 44, as compared with 144 for the same period of the previous year, 1912. For 1914 the number was 40 per cent less than for the year 1913; and for the year 1915, 17.6 per cent less than for the year 1914.

Blood examinations gave for May, 1914, May being the beginning of the malarial season, 11.76 per cent carriers of the parasite, and for April, 1915, 3.79 per cent, a reduction in the incidence of carriers of 67.7 per cent in the one year.

Mr. Hughes, the manager of the lumber mills, stated recently that no family had moved from Electric Mills during the year 1915; that the superintendent of schools reported the average attendance as unusually good; that the people were happy and healthy; that the labor efficiency was most satisfactory; and that these conditions were only to be attributed to the sanitation directed against typhoid and malarial fevers.

Credit is due to Dr. Cecil Champenois in carrying out the measures known to be effective in the control of these diseases.

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## PLAQUE-PREVENTION WORK.

### CALIFORNIA.

The following report of plague-prevention work in California for the week ended February 19, 1916, was received from Surg. Boggess, of the United States Public Health Service, in charge of the work.